Chemistry I: Working Gas Problems

2 math formulas:

Combined Gas Law: $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Ideal Gas Law: $PV = nRT$ $PV = \frac{g(R)T}{MW}$

To convert °C to Kelvin: $K = {}^{o}C + 273$

To convert °C to °F: ${}^{o}F = 1.8({}^{o}C) + 32$

To convert °F to °C : ${}^{o}C = \frac{({}^{o}F - 32)}{1.8}$

1. ALL temperatures (T) MUST be in Kelvins.
2. The same pressure units must be used on both sides of the equation.
3. If the problem states that a variable is constant, use "1" for that variable on both sides of the equation.
4. If a variable is NOT mentioned in a problem; then assume that it is constant.
5. Combined gas law problems will always give 5 of 6 variables.
6. Ideal gas law problems will give 3 of 4 variables or ask for the following:
    a. How many moles of……
    b. How many grams of……..
    c. What is the molecular weight of a gas…..
    d. What will be the volume of…….
    e. What is the temperature of…..
    f. What is the pressure of……

Ideal gas law problems:

There are two types used to find grams of gas or molecular weight (molar mass).

In these problems $\frac{\#g}{MW}$ is substituted for n for an equation that looks like this:

$$PV = \frac{g(R)T}{MW}$$

To select R.:

1. R must have the same units of pressure AND volume that are set out in the problem.
2. BUT…
    a. If the problem asks for volume ONLY then use an R with the same pressure as the problem. Then volume will be in L or mL.
    b. If the problem asks for pressure ONLY the use an R with the same units as the problem. Then the pressure units will be in mmHg, atm., or Torrs.

Correcting for water vapor.

One of the easiest ways to collect gas samples in the laboratory is to bubble the gas into an inverted gas-collecting bottle filled with water. In this process some of the water vaporizes to combine with the gas for the total gas pressure.

To correct the pressure for the collected gas only, the water vapor pressure must be subtracted from the total gas pressure. The amount of water vapor pressure depends on the temperature. The chart at the end of your notes shows what number to subtract from the total pressure.

$$P_{gas} = P_{total} - P_{water\ vapor}$$

How will you know when to do this?

The magic words " over water" or "collected over water" will appear in the problem.